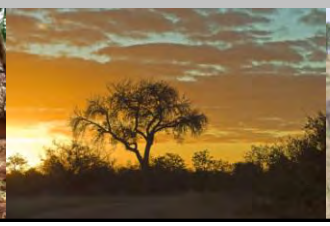
Introduction to Ecosystem Services and Climate Change

Beto Borges
Director, Community and Markets Program
Forest Trends
4 April 2011

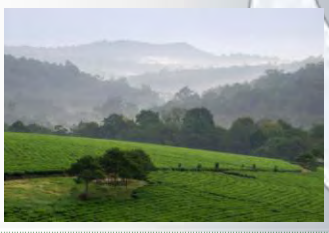
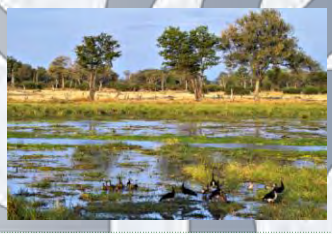

What Are Ecosystems?

Ecosystems are the combined interactions of:

Biological / living *(plant, animal and micro-organism communities*) components of environment

and

Physical / non-living components *(air, water, soil and the basic elements and compounds of the environment)*

Ecosystems in Uganda

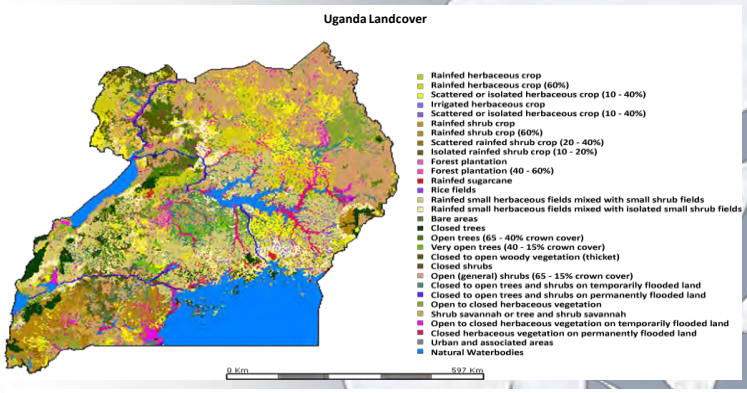


Figure prepared with data from: Food and Agriculture Organization of the United Nations. Africover. http://www.africover.org/webmap.htm

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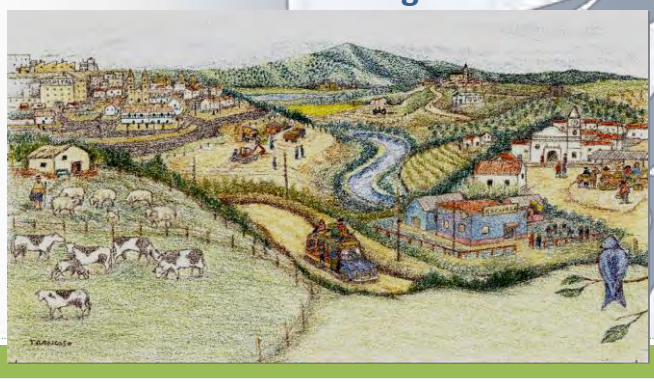
What are Ecosystem Services?

Natural and modified ecosystems have positive and negative effects on the air, water and natural resources which generate benefits for human beings.



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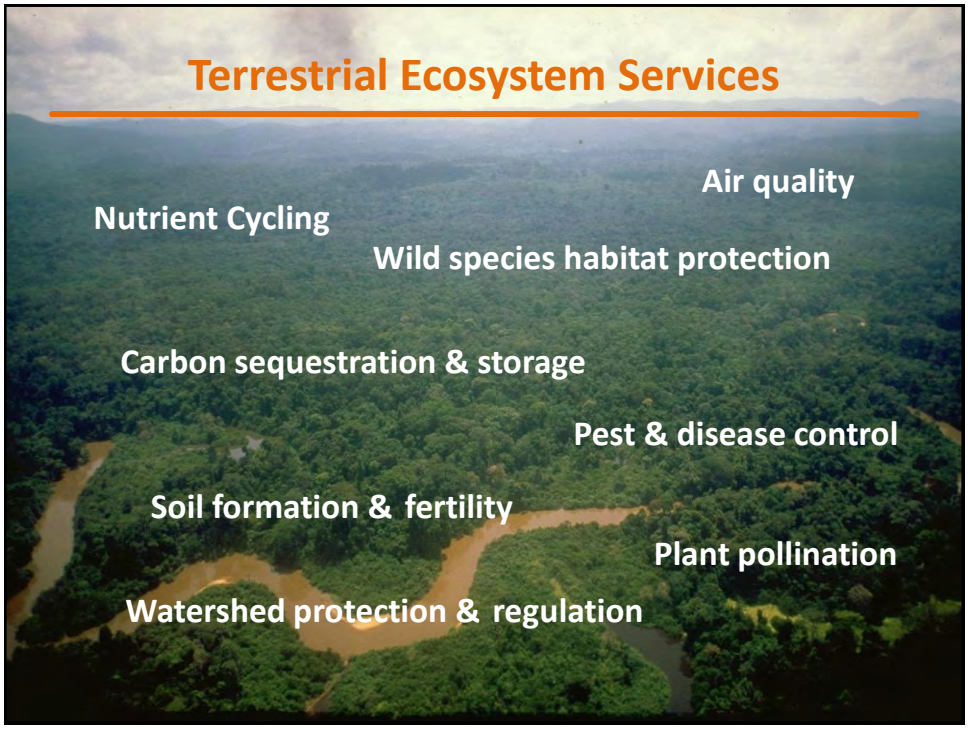
Terrestrial Ecosystem Services
Air quality
Nutrient Cycling
Wild species habitat protection
Carbon sequestration & storage
Pest & disease control
Soil formation & fertility
Plant pollination
Watershed protection & regulation


Marine and Coastal Ecosystem Services
Coastal Water quality
Stable Coastlines
Storm and Hurricane Protection
Sustainable Fisheries
Sandy Beaches
Safe and Healthy Seafood
Carbon sequestration and storage
Marine Biodiversity
Seascape and Landscape Beauty
Waste and Pollutant Processing

Categorizing Ecosystem Services

Ecosystems Services are the benefits that ecosystems provide, which include:

- ***Supporting services:*** Functions that maintain all other services
- ***Regulating services:*** Natural processes regulated by ecosystems
- ***Provisioning services:*** Goods or products produced by ecosystems
- ***Cultural services:*** Non-material benefits obtained from ecosystems

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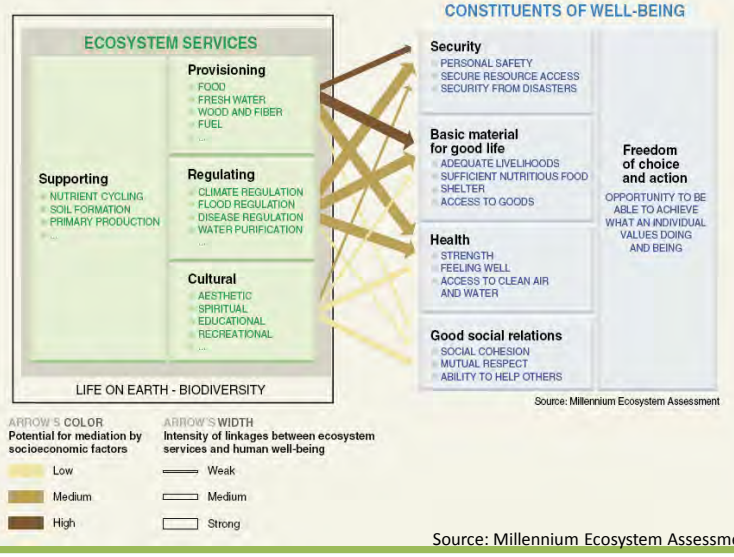
Categorizing Ecosystem Services



Source: Millennium Ecosystem Assessment

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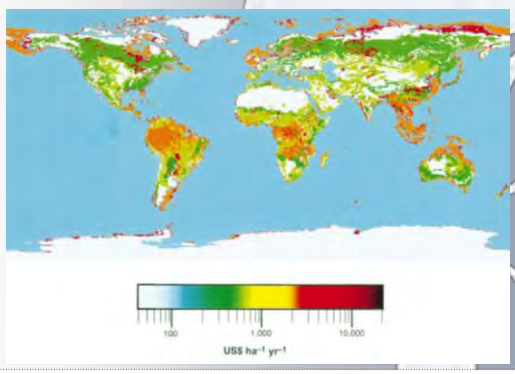
Value of Ecosystem Services

- Estimated value of ecosystem services is **more than $33 trillion per year**! (Compare this to global gross national product at only $18 trillion.)



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Source: Costanza R et al (1997) "The value of the world's ecosystem services and natural capita." *Nature*. 387 (15 May 1997) pp. 253-260.

Status of Ecosystem Services

- Millennium Ecosystem Assessment concluded that 60% to 70% of ecosystem services are being degraded faster than they can recover.

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Status of Ecosystem Services in Uganda

Four ecosystem services are critically stressed in Uganda:

- Maintenance of biodiversity
- Food and fiber provision
- Water supply, purification and regulation
- Fuel provision

UNEP and IISD. 2005. *Connecting poverty & ecosystem services: A series of seven country scoping studies: Focus on Uganda.*

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Region	Ecosystem services stressed	Constituents of human well-being threatened
Central	Biodiversity loss: mainly deforestation Food provision: soil degradation, drought and control of pests Water supply, purification and regulation: wetland degradation, low groundwater supply Fuel (energy): deforestation and wood deficit districts	Adequately nourished: almost 50 per cent of children stunted and severely stunted Adequate and clean water: prevalence of diarrhea Energy: wood deficit in many regions Ability to earn a livelihood: incidence of poverty mainly 20–25 per cent range
Eastern	Biodiversity loss: habitat fragmentation and land degradation Food provision: soil degradation, tsetse fly and control of pests Water supply, purification and regulation: wetland degradation, droughts and floods Fuel (energy): deforestation and some wood deficit districts	Adequately nourished: generally food insecure Adequate and clean water: prevalence of diarrhea Energy: wood deficit in a few regions Ability to earn a livelihood: Low – high areas poverty across districts
Northern	Biodiversity loss: land degradation, overgrazing and poaching Food provision: soil degradation, drought Water supply, purification and regulation: recurring droughts and floods Fuel (energy): large number of displaced persons	Adequately nourished: generally food insecure, most underweight children Adequate and clean water: drought, least access to water; diarrhea Energy: woodfuel shortage in two districts Ability to earn a livelihood: highest incidence of poverty
Western	Biodiversity loss: habitat fragmentation, deforestation, hunting and poaching Food provision: land and soil degradation and control of pests Water supply, purification and regulation: wetland degradation, water pollution Fuel (energy): wood deficit in many districts	Adequately nourished: high incidence of child stunting Adequate and clean water: incidence of river blindness, drought, prevalence of diarrhea Energy: wood deficit in many districts Ability to earn a livelihood: lower incidence of poverty with higher pockets

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Ecosystem Services and the Economy

A Key Part of Industry's Operational Infrastructure

	Forests	Oceans	Cultivated / Agricultural Lands
Environmental Goods	- Lumber - Wood Products - Firewood	- Fish & Seafood	- Crops (food & fiber)
Environmental Services	- Purification of air - Filtration of water -Nutrient cycling - Erosion & river siltation control - Soil formation - Generation/ renewal of soil fertility - Wind breaks	- Climate regulation (through carbon sequestration, role of currents, gulf stream, etc.) - Detoxification and decomposition of wastes	- Pollination of crops and natural vegetation - Control of agricultural pests - Moderation of temperature extremes

Ecosystem Services and the Economy

A Key Part of Industry's Operational Infrastructure

1. Environmental Goods
   food, freshwater, fuel, fiber
2. Regulating Services
   climate regulation, flood regulation, water filtration
3. Supporting Services
   nutrient cycling, soil formation
4. Cultural Services
   aesthetic, spiritual, educational, recreational

Product Inputs

Production Process Inputs

Stable Business Operating Context

Healthy worker fundamentals (e.g., clean air, adequate amounts of water, food, etc.)

Contributors to 'license to operate'

Ecosystem Services and the Economy

"**Environmental services are a core element of business infrastructure.** So fundamental that they are often overlooked…

…These services include protection of coastal areas and key infrastructure, such as harbors, the regulation of reliable and sufficient flows of water, the regeneration of productive soil, and the carbon sequestration in plants and soil…

…Replacing these services is not always technically possible or financially feasible."

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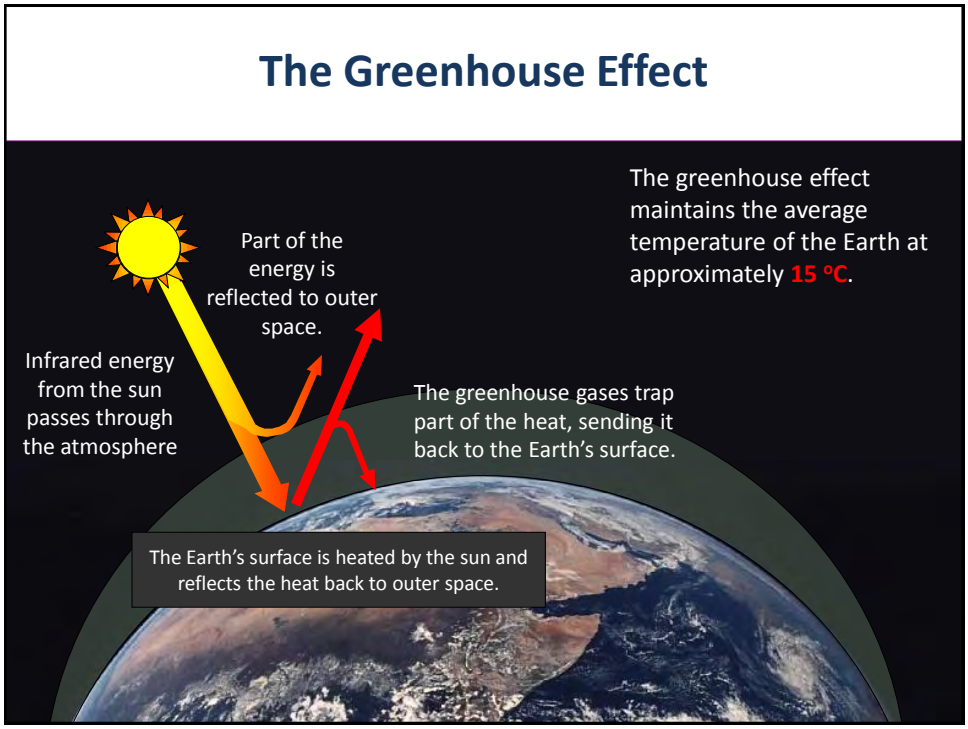
Source: BSR (2007) "The New Markets for Environmental Services: A Corporate Manager's Resource Guide to Trading in Air, Climate, Water, Biodiversity." (www.bsr.org)

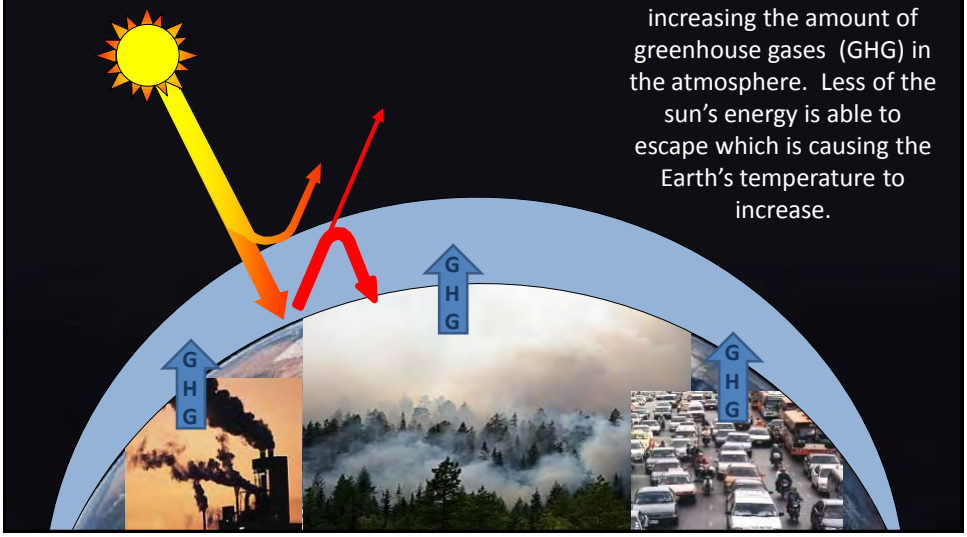
The Greenhouse Effect and Climate Change

The Greenhouse Effect



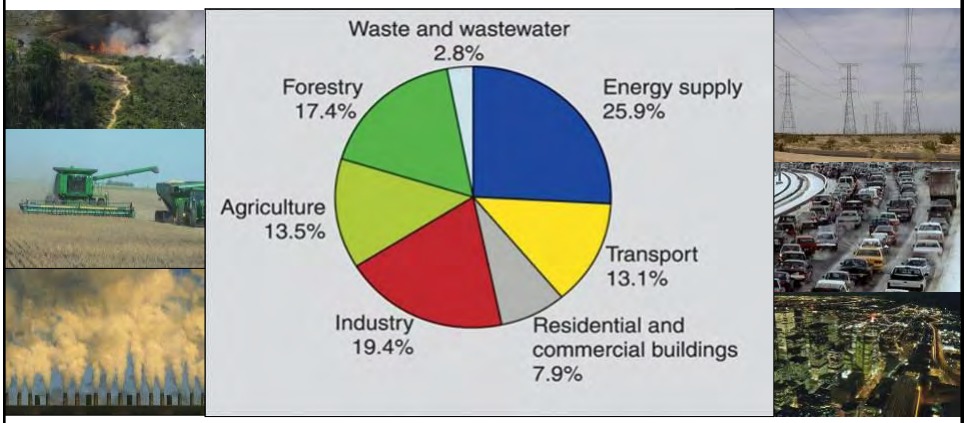
Without the greenhouse effect, the world would be too cold with an average temperature of -18°C!

The Problem:



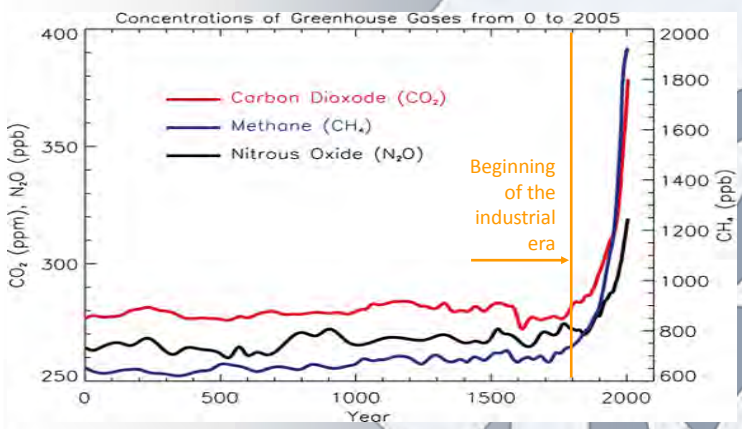
Human activities are increasing the amount of greenhouse gases (GHG) in the atmosphere. Less of the sun's energy is able to escape which is causing the Earth's temperature to increase.

Sources of greenhouse gases:



Sources: IPCC 4th Assessment Report, images from presentation by Ana Fortin.

How quickly are greenhouse gas concentrations increasing?



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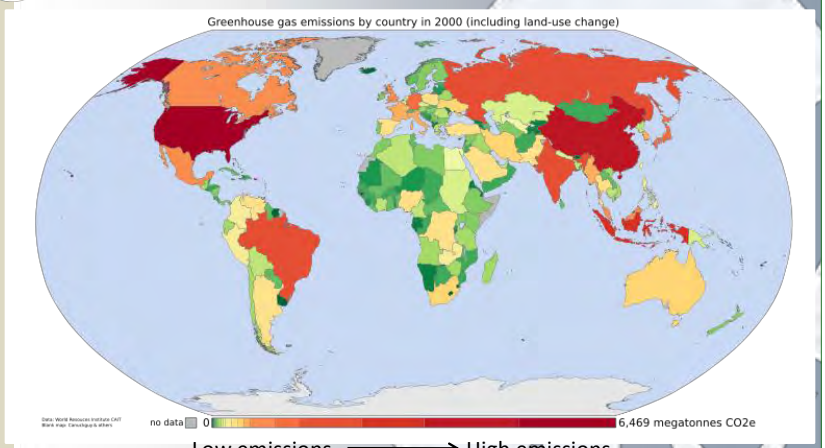
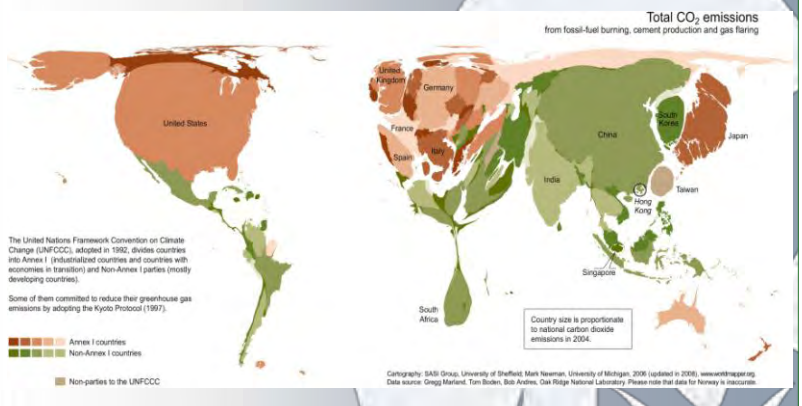
Where are the gases being emitted?

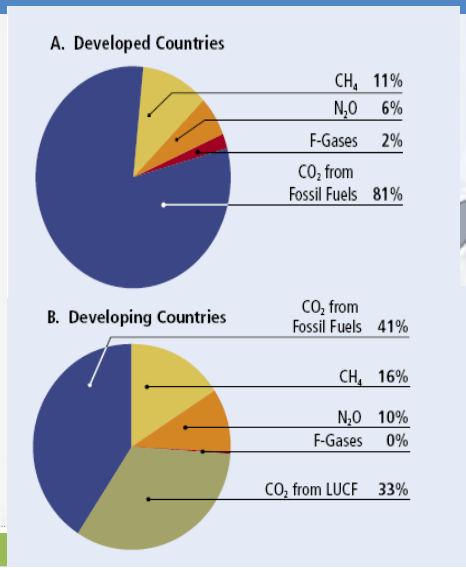


Source: World Resources Institute's CAIT 4.0 database

Where are the gases being emitted?



Emission Sources



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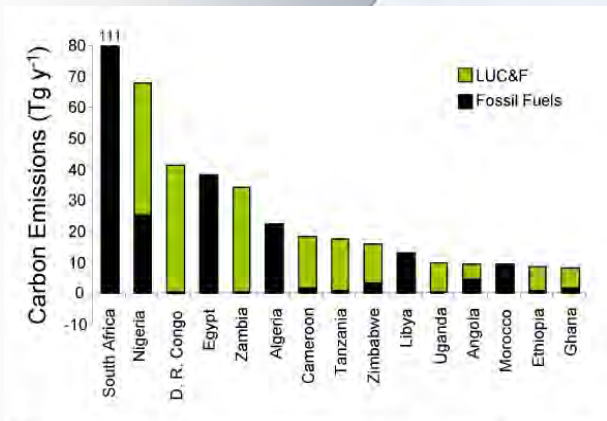
Emission Sources in Africa



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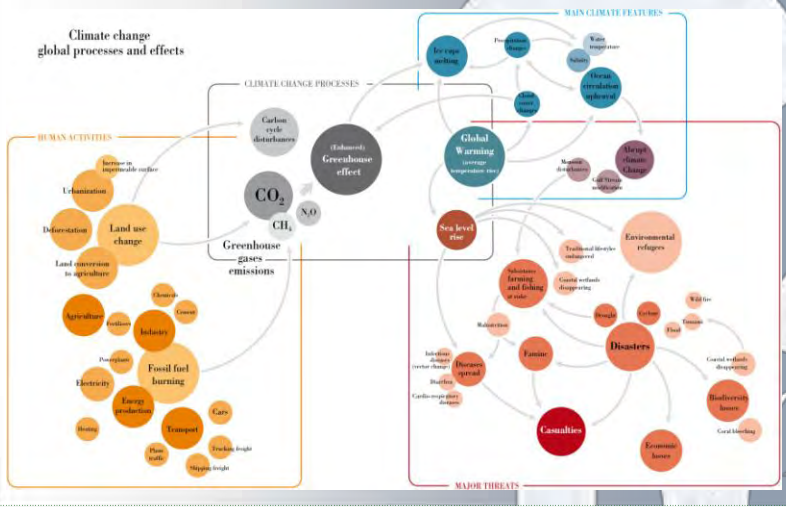
Global Processes and Effects



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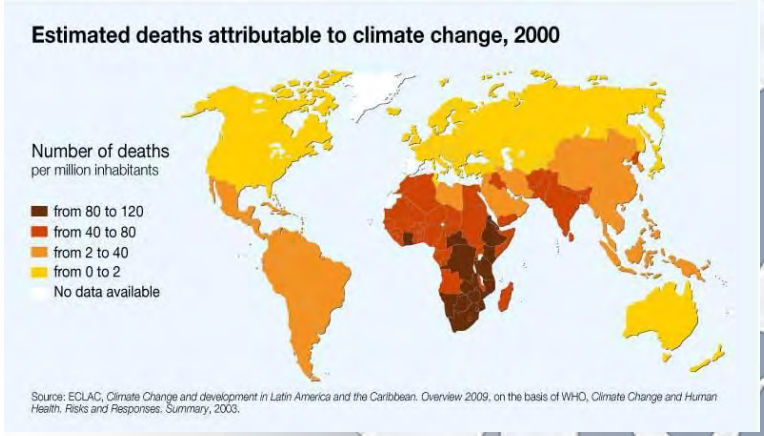
Source: http://maps.grida.no/library/files/climate-change-global-processes-and-effects_002.jpg

Evidence of Climate Change in Africa



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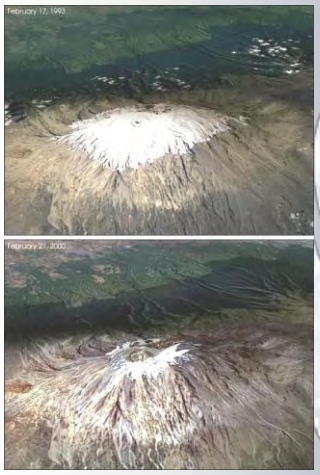
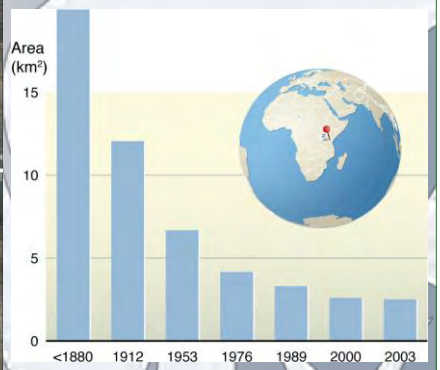
Evidence of Climate Change in Africa





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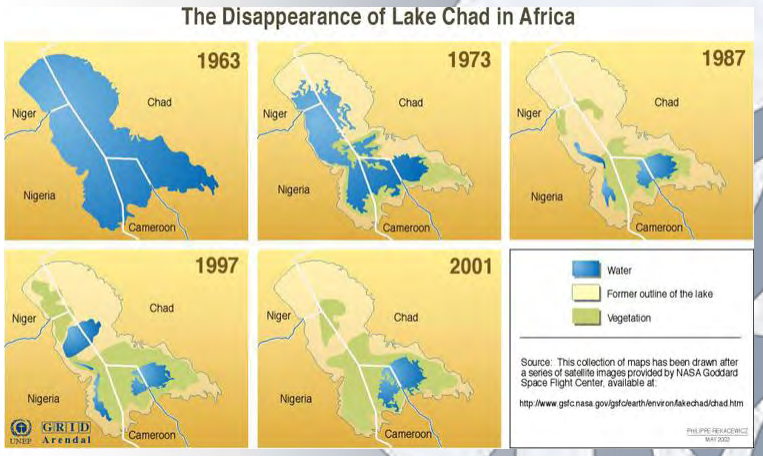
Source: http://blog.climatesecurity.org, http://maps.grida.no/go/graphic/melting-ice-on-mount-kilimanjaro-east-africa

Evidence of Climate Change in Africa



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Source: http://www.grida.no/_res/site/Image/series/vg-africa/graphics/14-lakechad.jpg

Evidence of Climate Change in Uganda

- Disappearance of glaciers on Rwenzori Mountains
- Severe hailstorms
- Lasting drought
- Massive flooding
- Changing rain cycles

Rwenzori Mountains

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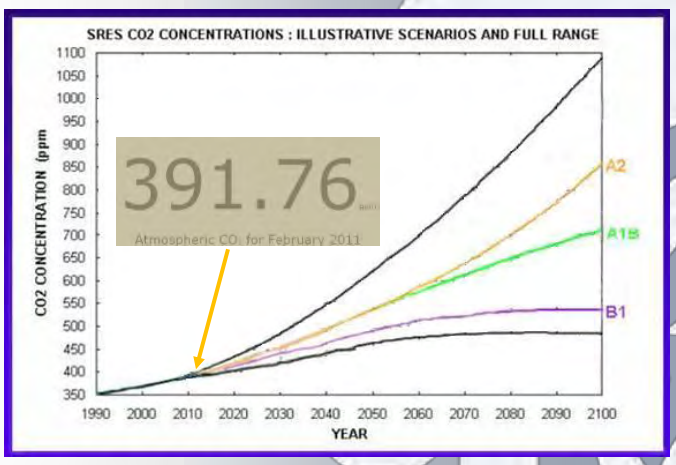
"Our contribution to climate change is almost insignificant, but we are being impacted heavily." – Goretti Kitutu (NEMA)

Source: http://www.redorbit.com/news/science/1705538/climate_change_threatens_ugandan_livelihood/

Future Predictions



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http://eos-webster.sr.unh.edu/data_guides/ci_dg.jsp;jsessionid=0F353EDC67B8647D2AC67ACD10648037

Future Effects of Climate Change

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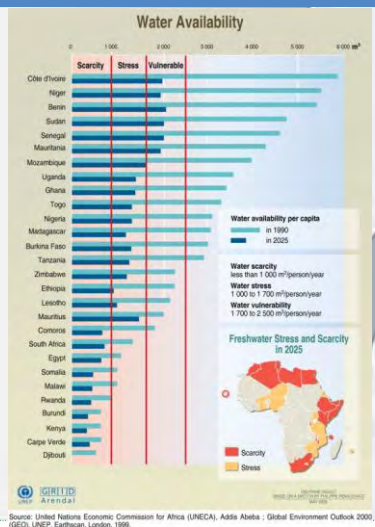
Water Scarcity



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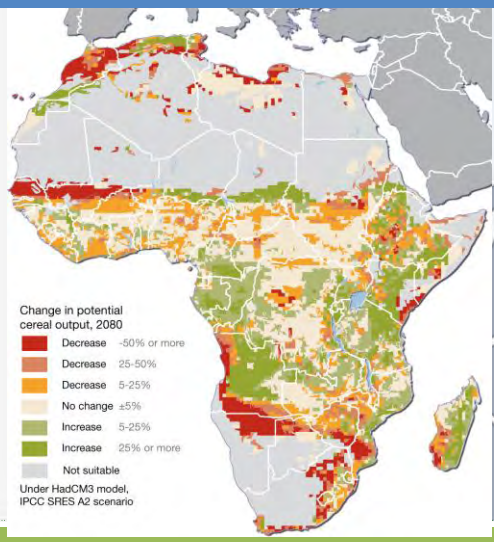
Source: http://maps.grida.no/go/graphic/water_availability_in_africa

Decreases in Crop Production



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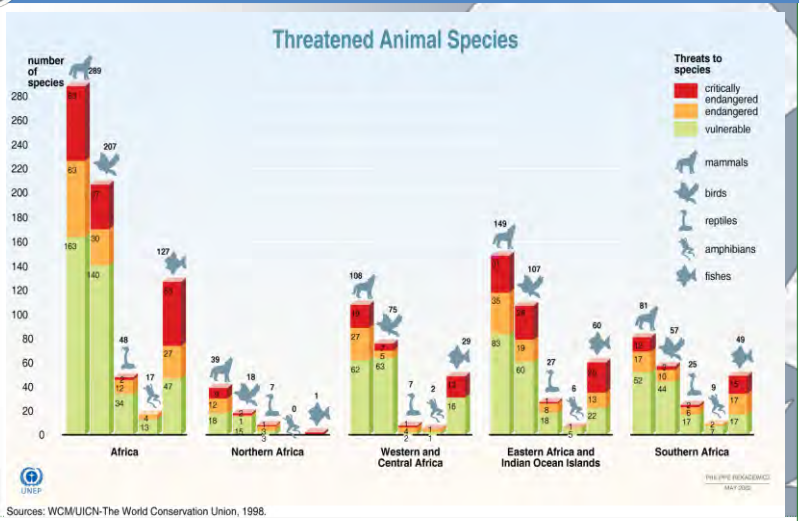
Source: http://maps.grida.no/go/graphic/projected-changes-in-cereal-productivity-in-africa-due-to-climate-change-current-climate-to-2080

Loss of Biodiversity



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Source: http://maps.grida.no/go/graphic/african-wildlife-under-threat-from-climate-change

So what can we do?

- **Suffer**
- **Adapt:** cultivate in different months, use different clothing
- **Mitigate:** reduce the size of the problem (PES, alternative energy sources, etc)

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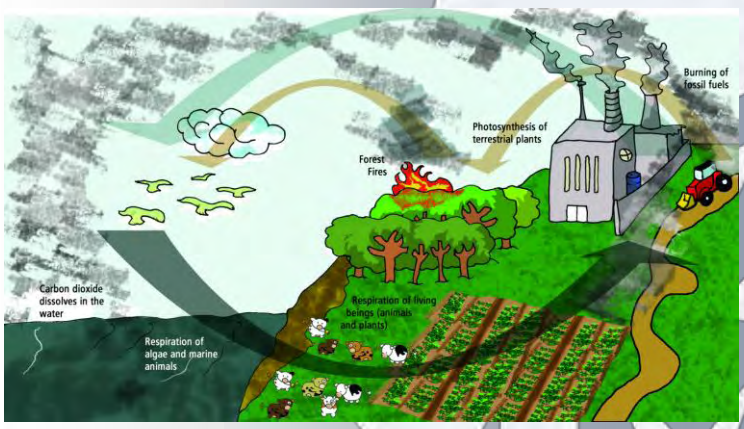
Carbon Sequestration



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What would happen if we could give ecosystem services (such as carbon sequestration) a financial value in our economic systems?

What would this look like and how would it work?

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For more Information:

Forest Trends
www.forest-trends.org

Ecosystem Marketplace
www.ecosystemmarketplace.com

Katoomba Group
www.katoombagroup.org

Beto Borges
bborges@forest-trends.org

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